TRIAL SERIES 13

COMPONENT

AVTP	TEST TITLE
13 – 10	General
13 – 20 T	Track
13 – 30 W	Tyre

ALLIED
VEHICLE TESTING
PUBLICATION

AVTP : 13-10
EDITION NO.: FINAL
DATE : SEP. 1991

NATO INTERNATIONAL STAFF-DEFENCE SUPPORT DIVISION

TRIAL SERIES : COMPONENTS

TEST TITLE : GENERAL

REFERENCE : STANAG 4357
STANAG 4358

EQUIVALENT :

FOR COMPLIANCE WITH : -

ABSTRACT : This AVTP describes procedures for conducting component tests which are relevant for all components.

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NORTH ATLANTIC TREATY ORGANISATION
MILITARY AGENCY FOR STANDARDIZATION (MAS)

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FOR THE MILITARY AGENCY OF STANDARDIZATION

(Signature)

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RECORD OF CHANGES, AMENDMENTS AND RESERVATIONS *)

Identification of Change or Amendment and Reg.No.(if any) and date	Date Entered	NATO Effective Date	By whom entered Signature, Rank, Grade or Rate, Name of Command

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Trial Series: COMPONENTS

Test Title : GENERAL

Paragraph

AVTP : 13-10
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1. SCOPE

This document describes general procedures which can be used for all component testing.
Component testing generally comprises testing with the vehicle used as a test rig and testing on test stands. Both types of testing are designed to determine performance maintainability , reliability and durability of the components.

This AVTP is directed to:

- Visual check and identification
- Pictorial documentation
- Main characteristics
- STANAG requirements
- Maintainability
- Replacement of wear-parts
  Disassembly and inspection after endurance tests

2. FACILITIES AND INSTRUMENTATION

2.1 Facilities

Workshop with crane equipped with authorised tools and equipment.

2.2 Instrumentation

DEVICES FOR MEASUREMENT OF:	PERMISSIBLE ERROR OF MEASUREMENT*
a. Time	5 %
b. Length	3 %
c. Weight	2 %

* The permissible error of measurement for instrumentation is the two-sigma value for a normal distribution; thus, the stated errors should not be exceeded in more than 1 measurement of 20.

AVTP : 13-10
EDITION NO.: FINAL
DATE : JAN. 1994

3. REQUIRED TEST CONDITIONS

a. Ensure that the test item is prepared and equipped as specified by the test plan.

b. If necessary, test item must be in transport configuration.

c. The prescribed tools, test equipment and technical documents (manuals, design drawings) must be on hand.

4. TEST PROCEDURE

4.1 Initial Inspection

Check for and take note of:

a. Shipment contents
b. Name plate
c. Design status
d. Completeness
e. Defects

Perform necessary corrections to d. and e..
Mark test item with test plan number.

4.2 Photographs

Take pictures from all sides of the test item and/or as specified by the test plan.

4.3 Dimensions, Weight and Center of Gravity

Take measurements of test item for dimensions, weight, and center of gravity (if required) as specified by the test plan.

4.4 Specifications and Regulations

Check for non-concurrence with specifications and regulations (STANAG, AP, US and EEC regulations, National regulations, etc.), as specified by the test plan.

4.5 Maintainability

Use AVTP 02-10 "Vehicle Maintenance" to perform maintenance according to NATO Maintenance Levels A, B and C.

4.6 Disassembling and Final Inspection
(after Endurance Tests; see AVTP 11-10)

4.6.1 After endurance tests check for:

a. Leakages
b. Status and contamination of fluids
c. Wear or damages
d. Cracks
and take photographs where appropriate.

4.6.2 Disassemble test item completely and check for:

a. Damages
b. Wear
c. Cracks

and take photographs where appropriate.

5. DATA REQUIRED

5.1 Initial Inspection

a. Shipment contents
b. Descriptive data supplied by the manufacturer
c. Relative maturity of components in design process
d. Comparison of component to latest design specifications
e. Actions to complete or repair the test item
f. Location of test plan number on test item

5.2 Photographs

Photographs as defined in para 4.2

5.3 Dimensions, Weight, and Center of Gravity

a. Length, width and height of test item.
b. Location of specific parts defined by the test plan.
c. Weight (with and without fluids)
d. Location of center of gravity (if required).

5.4 Specifications and Regulations

Details of non -compliance with specifications and regulations.

5.5 Maintainability

Observations on

a. Hardware design
b. Tools and equipment
c. Maintenance manuals and technical documentation
d. Repair parts
e. Time taken
f. Training skill
g. Safety hazards
h. Suggestions of warnings

5.6 Disassembling and Final Inspection

List of observations according to para 4.6.

6. PRESENTATION OF DATA

Present the required data in narrative, tabular, graphical, pictorial or other format as appropriate.

Include:

Description of laboratory techniques as required.

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AVTP : 13-20 T
EDITION NO.: FINAL
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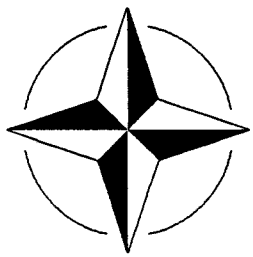

NATO INTERNATIONAL STAFF-DEFENCE SUPPORT DIVISION

TRIAL SERIES : COMPONENTS

TEST TITLE : TRACK

REFERENCE : STANAG 4357
STANAG 4358
AVTPs of para 4.2
AVTP 11-10

EQUIVALENT :

FOR COMPLIANCE WITH : -

ABSTRACT : This AVTP describes how to conduct specific track tests. General procedures are covered by AVTP 13-10.

91

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NORTH ATLANTIC TREATY ORGANISATION
MILITARY AGENCY FOR STANDARDIZATION (MAS)

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FOR THE MILITARY AGENCY OF STANDARDIZATION

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EDITION NO.: FINAL
DATE : SEP. 1991

Trial Series: COMPONENTS

Test Title : TRACK

Paragraph

AVTP : 13-20 T
EDITION NO.: FINAL
DATE : JAN. 1994

1. SCOPE

This AVTP describes track tests for collecting data to be used in the evaluation of the performance, reliability and durability of tracks.
Tracks are essential for safe locomotion of tracked vehicles. They are exposed to intensive stress and wear and are the main source for the high noise and vibration level in and outside of tracked vehicles.

2. FACILITIES AND INSTRUMENTATION

2.1 Facilities

a. Laboratory with appropriate instrumentation and devices for weight, hardness and force measurements etc.

b. Paved, level test course for para 4.3

c. As specified in referenced AVTPs.

2.2 Instrumentation

DEVICES FOR MEASUREMENT OF:	PERMISSIBLE ERROR OF MEASUREMENT*
a. Weight	1 %
b. Force	1 %
c. Hardness	2 %
d. Length	0.3 %
e. Angle	10 mrad
f. Temperature	1 °C
g. Speed	5 %

h. Time	1 %
i. Others	as specified in referenced AVTPs

* The permissible error of measurement for instrumentation is the two-sigma value for a normal distribution; thus, the stated errors should not be exceeded in more than 1 measurement of 20.

3. REQUIRED TEST CONDITIONS

3.1 Laboratory
The laboratory must be equipped to the generally accepted standard.

3.2 Test Courses
As specified in referenced AVTPs. For para 4.3 the test course must be dry and the temperature must be above 5°C.

3.3 Vehicle
The vehicle must be prepared and equipped as specified by the test plan. The weight distribution should be given particular attention.

3.4 Tracks
AVTP 13-10 should be performed before starting with AVTP 13-20 T.

4. TEST PROCEDURE

4.1 Laboratory Tests (optional)
(For definitions of track link components see ANNEX A)

a. Select five track links from a track set at random and measure the dimensions of the track links and compare with the design dimensions.

b. Check surfaces which contact sprockets, track centre guide, and rubber pad for correct design dimensions.

c. Disassemble the selected track links.

d. Define surface areas relevant for correct functioning of tracks.

e. Obtain data to calculate ground contact areas and weight
(1) With pads
(2) Without pads
(3) With grousers (if applicable)
(4) Of parts (each 5 parts together)

f. Measure hardness values of areas defined in 4.1.d.

g. Measure force and extension of a track string of three selected track links until rupture occurs.

h. Select a section of approximately 1 m in length. While twisting the track section about its longitudinal axis, measure torque versus angle.

i. Measure physical properties of rubber pads according to specified methods (e.g.: GE uses TL 2500-002).

4.2 Performance Tests

The following AVTPs are recommended:

01-20, 02-10
03-30, 03-40, 03-70
03-80, 03-90, 03-100, 03-120
03-140, 03-150,
05-20, 05-60
09-30, 09-90
10-30

4.3 Thermal Stress at Maximum Vehicle Speed

Drive the vehicle at maximum speed on a paved level and dry test course until critical or stabilised temperatures are reached. Measure temperature of rubber parts (surface and internal, as required) of the track before start and each 15 minutes until the test run is finished.

4.4 Endurance Tests

a. Set the optimum track tension in accordance with the vehicle operating or maintenance procedures. When applicable, the optimum track tension must determined empirically. The method by which the optimum track tension is determined must be described. Record total mileage after completion of endurance test and when pads are 5 mm above grousers. Measure the length of a the track or of a percentage of the track under optimum track tension before and after testing.

b. Drive the vehicle for 50 km on paved road at 25 km/h. Check all track elements and adjust screws, connectors and bolts as necessary.

c. Perform endurance runs according to AVTP 11-10 and after each cycle measure track tension and wear.

d. Check for cracks by using appropriate techniques after each cycle.

5. DATA REQUIRED

5.1 Laboratory Tests

Track data of para 4.1 a, d, e, f, g, h and i.

5.2 Performance Tests

a. Data required for each used AVTP.
b. Optimum track tension

5.3 Thermal Stress at Maximum Vehicle Speed

a. Temperatures of rubber parts of the track as specified in the test plan.

b. Air temperature.

c. Driving Time.

d. Average Speed.

e. Description of test course.

5.4 Endurance Tests

a. Optimum track tension and track tension after each cycle.

b. Description of cracks (photographs).

c. Mileage after completion of endurance tests.

d. Mileage, when pads are still 5 mm above grousers.

e. Wear of the defined surfaces in para 4.1d and rubber parts.

f. Total or percentage elongation of track.

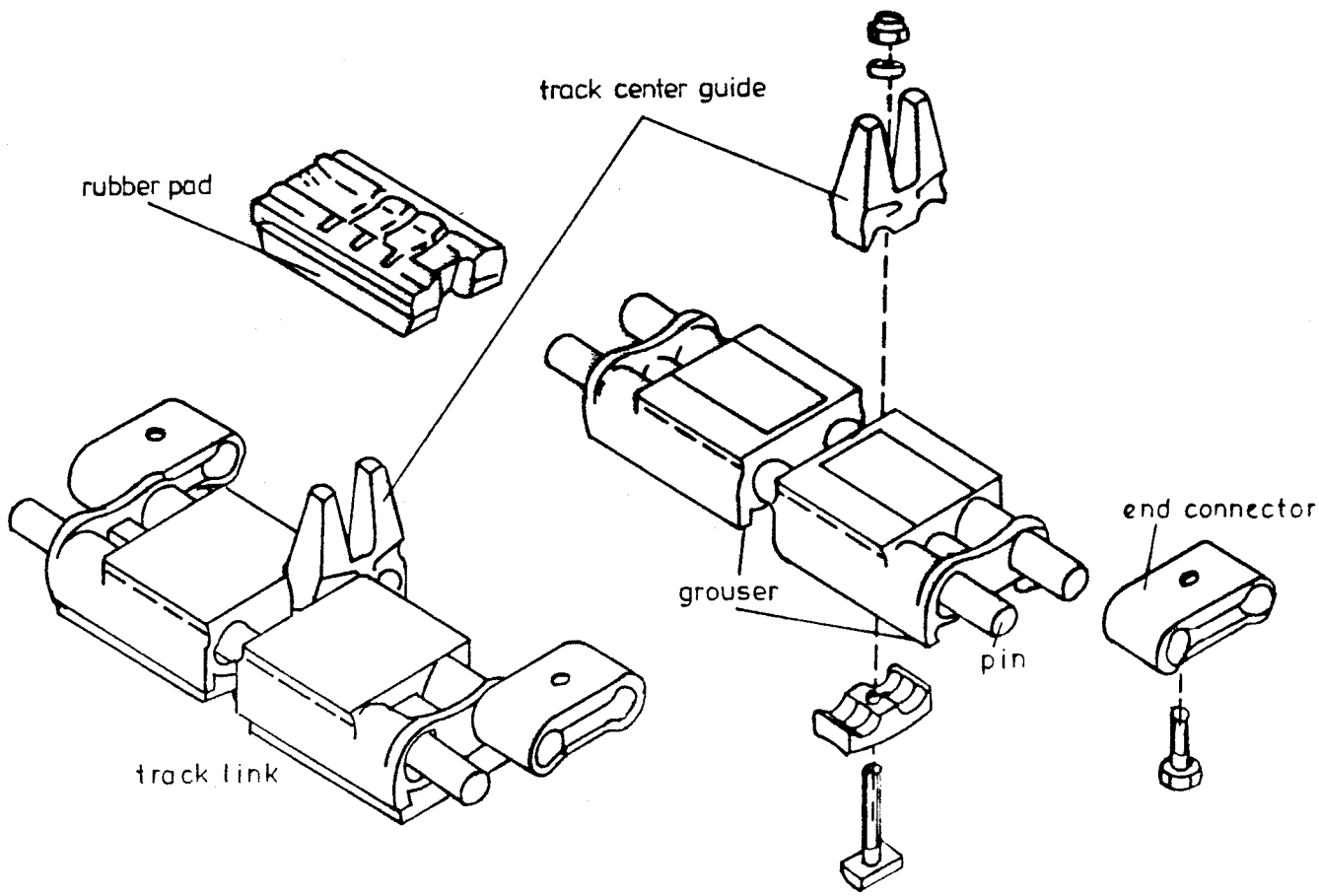
6. PRESENTATION OF DATA

Present the required data in narrative, tabular, graphical, pictorial or other format as appropriate.

Include:

- List of measured and design dimensions.
- Average weight of track links and their parts.
- Weight per meter of track.
- Weight of tracks for vehicle.
- Usable height of pad-wear.
- Height of grouser above new pad.
- Comments concerning hardness and strength of material.
- Force-extension function for 1 meter track length.
- Force when rupture of track occurs.
- Torque-angle function for 1 meter track length.
- Total or percentage elongation of track after completion of endurance runs.
- Individual wear values of all components.
- Mean, rms and deviation wear of selected track links.
- Average wear as function of endurance mileage.
- Observation of rubber chunking.
- Temperatures of rubber parts of a track link versus time.
- Calculation of permissible driving time at maximum speed by extrapolation to 20°C and 40°C air temperature or as specified otherwise.
- Description of laboratory techniques, as required.

ANNEX A: EXAMPLE OF TRACK LINK COMPONENTS



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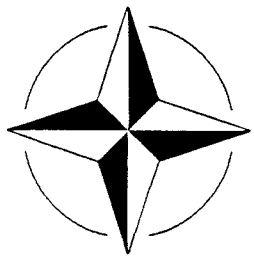

NATO INTERNATIONAL STAFF-DEFENCE SUPPORT DIVISION

TRIAL SERIES : COMPONENTS

TEST TITLE : TYRE

REFERENCE : STANAG 4357
STANAG 4358
ISO 4223-1
ISO 9112

EQUIVALENT :

FOR COMPLIANCE WITH : -

ABSTRACT : This AVTP describes how to conduct specific tyre tests. General procedures are covered by AVTP 13-10.

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NORTH ATLANTIC TREATY ORGANISATION
MILITARY AGENCY FOR STANDARDIZATION (MAS)

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Test Title : TYRE

Paragraph

AVTP : 13-30 W
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1. SCOPE

This AVTP describes tyre tests for collecting data to be used in evaluating performance, reliability and durability of tyres.
Tyres are important for safe and effective locomotion of military vehicles on roads and adverse terrains.

2. FACILITIES AND INSTRUMENTATION

2.1 Facilities

a. Laboratory with appropriate instrumentation and devices for weight, hardness and force measurements etc.

b. As specified in referenced AVTPs.

c. High speed track and road circuit.

2.2 Instrumentation

DEVICES FOR MEASUREMENT OF:	PERMISSIBLE ERROR OF MEASUREMENT*
a. Weight	1 %
b. Force	1 %
c. Hardness	2 %
d. Length	0.3 %
e. Angle	10 mrad
f. Tyre temperature	1 °C
g. Tyre pressure	10 kPa
h. Others	as specified in referenced AVTPs

* The permissible error of measurement for instrumentation is the two-sigma value for a normal distribution; thus, the stated errors should not be exceeded in more than 1 measurement of 20.

3. REQUIRED TEST CONDITIONS

3.1 Laboratory

The laboratory must be equipped to the generally accepted standard.

3.2 Test Courses

As specified in referenced AVTPs.

3.3 Vehicle

The vehicle is prepared and equipped as specified by the test plan. The weight distribution should be given particular attention.

3.4 Tyres

Tyres should be new (or as specified by the test plan) and should be marked with the test plan number.
AVTP 13-10 para 4.1 and 4.2 should be carried out prior to this AVTP.

4. TEST PROCEDURE

4.1 Laboratory Tests

a. Perform tests and checks in accordance with standards concerned with the properties of tyre compounds including resistance to fuel, ozone, UV, etc., if required.

b. Measure section width, overall width, overall diameter, static radius, tread depth, weight, static unbalance and rolling circumference. Measurements should be made at speeds, pressures and loads, where applicable, as specified in the test plan. (Examples of definitions of some measurements are shown at ANNEX A to this AVTP)

c. Measure spring rate of tyre from minimum load to maximum rated load at all pressures specified by the test plan.

d. Measure ground contact area on a hard surface at different loads up to maximum for all pressures specified by the test plan.

e. With the tyre mounted on a suitable test rig and inflated to the specified pressure, run the tyre at a range of speeds up to maximum. For each speed, monitor the temperature of the following points at 15-minute intervals until the temperatures stabilise or reach the maximum allowed, if required.

(1) Surface contact area
(2) Side wall
(3) Ambient air
Carry out the test

a) for all pressures and loads specified in the test plan

b) twice with new tyres, if required.

f. Measure maximum resistance to blow-out under excessive pressure. For safety reasons the tyre may be pressurized using water.

4.2 Performance Tests

The following AVTPs must be considered when preparing the test plan:

03-10/30/40/60/80/90/140/150/160/170
09-40
10-30

4.3 Thermal Stress at Maximum Vehicle Speed

Drive the vehicle at maximum safe speed on a paved level and dry test course until critical or stabilised temperatures are reached. Measure temperatures of test tyres at different specified locations (as detailed in the test plan) before the start and, then every 15 minutes until the test run is finished. Carry out this test for all vehicle load/tyre pressure combinations specified in the test plan.

4.4 Run Flat Tyre Performance

The capability of a tyre to operate satisfactorily after having been perforated should be checked by tests both on and off-route. An example of Run-Flat tyre testing is given in FINABEL 20 A 5. Alternative methods may be used and these should be described in detail as necessary.

4.5 Resistance to Shock on Calibrated Obstacles

a. These tests are carried out using square section perpendicular obstacles as defined in the test programme (minimum height 100 mm).

b. Tests are carried out for each combination of vehicle load and tyre pressure defined in the test programme.

c. The vehicle is to be driven at a steady speed at right angles to the obstacle and across it: the test is repeated with a gradual increase of test speed up to the maximum specified in the test programme or until deterioration.

d. The test at 4.5c is repeated but with an angle of incidence of 45° to the obstacle.

4.6 Endurance Tests

a. Measure tread depth before and after each cycle of endurance runs.

b. Perform endurance runs according to AVTP 11-10.

c. Take photographs of worn-out tyres.

5. DATA REQUIRED

5.1 Laboratory Tests

a. Required data of para 4.1 a

b. - Width of tyre
- Diameter of tyre
- Static radius of tyre
- Tread depth of tyre
- Weight of tyre
- Static unbalance of tyre
- Rolling Circumference

c. Spring rate of tyre, pressure

d. Ground contact area, load, pressure

e. Temperature, speed, load, pressure

f. Pressure

5.2 Performance Tests

Data required for each AVTP used is detailed in the relevant AVTP.

5.3 Thermal Stress at Maximum Vehicle Speed

a. Temperature
b. Time
c. Average maximum safe speed
d. Vehicle load
e. Pressure

5.4 Run Flat Performance:

As specified in the test being used

5.5 Resistance to Shock on Calibrated Obstacles

- Obstacle size
- Tyre pressure
- Vehicle speed
- Incidence angle
- Remarks concerning the condition of the tyre after crossing the obstacle.
- Vehicle load

5.6 Endurance Tests

Required data according to para 4.6 a through c.
a. Tread depth
b. Mileage
c. Time
d. Photographs

AVTP : 13-30 W
EDITION NO.: FINAL
DATE : SEP. 1991

6. PRESENTATION OF DATA

Present the required data in narrative, tabular, graphical, pictorial or other format as appropriate.

Include:

a. Average tread depth.
b. Picture and area of contact areas at different loads, for each tyre pressure.
c. Difference between maximum measured tyre body temperature and air temperature as a function of speed, for each pressure and load combination tested.
d. Pressure rise in the tyre as a function of time with different speeds for each load as the parameter.
e. Data presentation as specified in referenced AVTPs.
f. Description of standards used.

AVTP : 13-30 W
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ANNEX A: PNEUMATIC TYRES DIMENSIONS